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Creation of an Interactive Virtual Surgical Rotation for Undergraduate Medical Education During the COVID-19 Pandemic

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OBJECTIVE: During the coronavirus 2019 pandemic, medical student involvement in direct patient care has been severely limited. Rotations mandatory not only for core curricula but also for informing decisions regarding specialty choice have been postponed during a critical window in the application cycle. Existing virtual rotations are largely observational or lack patient-facing components.

SETTING: A virtual Otolaryngology - Head and Neck Surgery rotation at the University of Pennsylvania (Philadelphia, Pennsylvania) was implemented for medical students, comprising interactive live-streamed surgeries, outpatient telehealth visits, and virtual small group didactics.

RESULTS: Medical students enrolled in the virtual surgical rotation were able to engage with attending surgeons and operating room staff while remotely viewing surgical procedures captured with first-person audiovisual technology. Students participated in several different aspects of care delivery in both the inpatient and outpatient setting, similar to their typical responsibilities of an in-person rotation.

CONCLUSIONS: The authors will continue to develop the virtual surgical education methodology to further disseminate an interactive video-based medical student elective to other procedural specialties and institutions. (J Surg Ed 78:346–350. © 2020 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: virtual surgical education, undergraduate medical education, COVID-19, telemedicine, surgical video capture

COMPETENCIES: Patient Care, Medical Knowledge, Professionalism, Interpersonal and Communication Skills

INTRODUCTION

The traditional methods of undergraduate medical education (UME) have been suspended in light of the novel coronavirus 2019 (COVID-19) pandemic, necessitating innovation in educational programs.[1]

Endoscopy, laparoscopy, and robotic surgery are widely used in many surgical disciplines and enable surgical visualization by those who are not directly participating. Furthermore, utilizing first-person video technology better captures the operative field in open procedures in which direct observation may be challenging for all but the primary surgeon.[2] Video conferencing platforms are also now widely used for education and telemedicine.[3,4]

Combining these technologies with the current limitations in UME, we created a virtual Otolaryngology - Head and Neck Surgery (OHNS) medical student elective. In our institution, virtual electives, particularly surgical ones, are limited and none include a virtual operating room experience. We developed a virtual surgical curriculum that included virtual operative, clinical, and

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didactic experiences, emphasizing active participation to best recreate an in-person rotation experience.

MATERIAL AND METHODS

Design of Virtual OHNS Elective Rotation

The virtual elective in OHNS was designed to enable medical students to actively, but virtually, participate in the evaluation, management, and care of head and neck surgical oncology patients. Patient consent was obtained for all video capture and secure streaming during procedures and for the delivery of care in a telehealth setting.

Virtual Operating Room Experience

A virtual surgical experience was created with the combination of a commercially-available GoPro® camera and our institution-licensed, Health Insurance Portability and Accountability Act compliant, video-conferencing platform, BlueJeans (BlueJeans, Verizon Enterprise Solutions LLC, Mountainview, California), to allow real-time, 2-way audiovisual communication between the student and the operating team. Attending surgeons and/or residents wore a head-mounted GoPro camera with a modified lens to capture the optimal surgical field of view (Fig. 1), which was streamed to a mobile device and then screen-shared on the video-conferencing platform (Figs. 2 and 3). This allowed attending surgeons to explain the procedure step-by-step, demonstrate relevant anatomy, and engage in a dialogue with the students as they would in person.

For optimal audio quality while communicating with students, attending surgeons also wore Bluetooth® earphones that were wirelessly connected to the video call. For surgical cases that utilized a video tower as part of the standard setup, such as endoscopy or robotic surgery, the live surgical video could be easily shared directly through the video-conferencing platform via webcam.

Telehealth Experience

The goal of the telemedicine-based ambulatory component of the elective was to allow medical students to build skills in clinical interviewing, presentations, and outpatient management. Our department conducted telemedicine visits via platforms such as BlueJeans and Doximity (Video Dialer Beta, Doximity Inc., San Francisco, California).

Consenting patients were video called by the medical student, who performed a history and physical exam, presented to and discussed the case with the attending, and then joined the attending for the full telehealth visit.

Additionally, for the limited number of in-person outpatient visits with consenting patients, the attending would video-conference the students on a laptop or tablet placed in the examination room to enable observation of the attending conducting the visit.

Virtual Didactics and Interactive Discussions

Medical students presented patients at virtual multidisciplinary head and neck tumor board and attended virtual OHNS grand rounds and resident didactics. Students participated in small group discussions with attending otolaryngologists covering topics ranging from evaluation and work up of a neck mass to airway management.

FIGURE 1. Head-mounted GoPro® worn by the lead surgeon, compatible with loupes with integrated headlight.

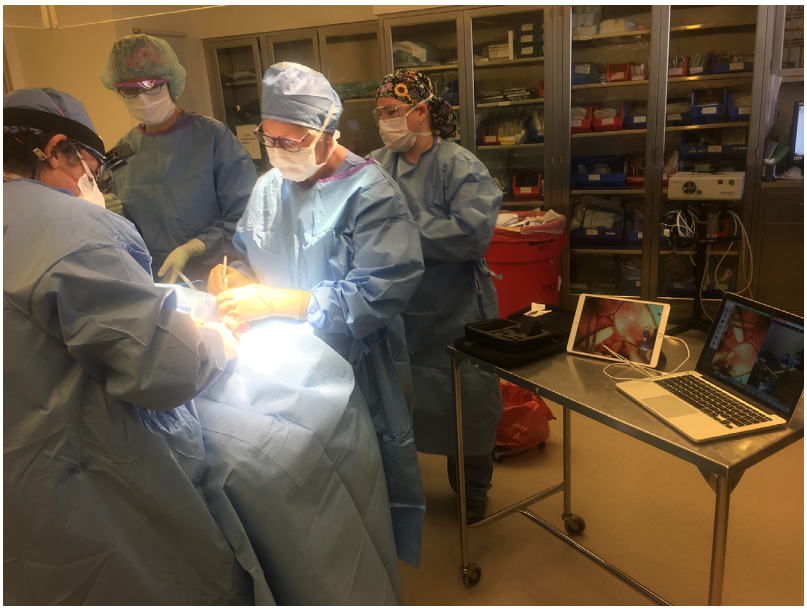

FIGURE 2. Non-sterile table across from lead surgeon with streaming device (iPad) to confirm operative field of view, and HIPAA compliant video-conferencing platform (laptop), enabling 2-way audiovisual communication between the student(s) and the operating team.

DISCUSSION

Advances

The creation of a virtual elective is an important first step towards re-imagining UME opportunities throughout the COVID-19 pandemic and beyond. The return of medical students to direct patient contact requires the balance of education with minimizing risks to the student, patients, and staff. In OHNS, the need for sustainable UME alternatives is further compounded by the elevated risk of occupational exposure to COVID-19 given the aerosol-generating nature of many OHNS procedures.[5]

The virtual elective is not a replacement for true experience in the operating room and in clinic, but it accomplishes the goals of exposure to the specialty and engagement with faculty. In fact, medical students on this virtual rotation spend more one-on-one time with attendings compared with traditional electives at our institution

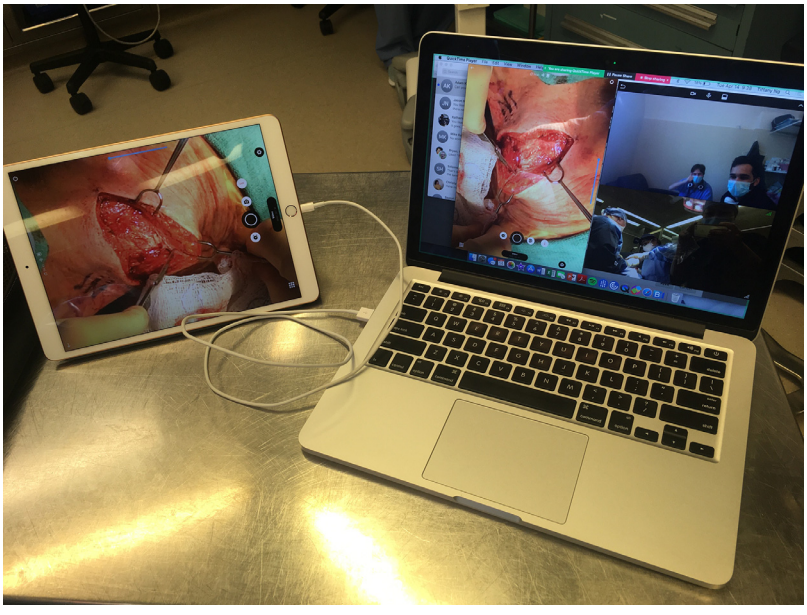

FIGURE 3. Close up of streaming tablet (left) and laptop hosting video-conferencing platform (right).

where medical students are integrated into resident-led services. This additional time spent with attendings may be highly influential for prospective residency applicants. Indeed, the top 3 criteria of candidate selection are personal knowledge of the applicant, letters of recommendation, and rotation within the department, all of which could be satisfied by this virtual rotation.[6]

In the creation of this curriculum, we tried to mitigate the natural barriers of any virtual experience by emphasizing active participation of the students. Instead of including pre-recorded surgical videos, use of live-streamed wearable video recording devices combined with video-conferencing platforms allowed for a surgical view and ability to interact with the surgical team, comparable to an in-person experience. In fact, the narrow operative field of most OHNS procedures often limits observation by anyone other than the primary surgeon. These surgeries are well suited for use of wearable video technology systems, and may lead to improved observer engagement.

Additionally, the virtual elective exposes medical students to telehealth, which is largely nonexistent in medical school curricula.[7] The elective allows the students to not only gain proficiency in evaluating patients in a surgical practice, but also familiarizes them with telehealth practices that they are likely to use in their careers.[4]

Limitations

Virtual simulation of a surgical educational experience leads to obvious limitations in OR and clinic experience. Not only does this include the acquisition of physical examination and procedural or technical skills, but there may also be limitations in their ability to discern whether the daily work of a surgeon fits with their professional and personal aspirations. In addition, with the clinical limitation to essential surgeries and office visits, students are not exposed to the full scope of a surgical specialty. For resident and attending surgeons, there are also limitations in ability to evaluate medical students on non-cognitive domains and personality traits desirable in surgical trainees.[8]

Future directions include evaluating both the efficacy of this virtual platform and the performance of medical students that participate. Though the rotation is graded as pass/fail, whether a program can adequately evaluate a student on the basis of a virtual rotation needs to be determined. Likewise, as rotating students often use specialty rotations to determine fit with a specialty or program, it also remains to be determined whether a virtual rotation is sufficient to make these decisions. We are currently exploring its application for medical students who would normally complete away rotations.[9]

CONCLUSION

We report on the innovative design and feasibility of a virtual video-based medical student elective. The methods presented here for virtual surgical education during the COVID-19 pandemic overcome many of the limitations of other virtual learning curricula by emphasizing an interactive live-streamed surgical experience and patient-facing telehealth visits, simulating an in-person rotation experience. Use of such innovative technologies for education may not only be applicable to COVID-related UME limitations, but also may be expanded for use wherever demonstrative methods of teaching are necessary for medical education.

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